to do with the speedy cure, and concluded that by the manipulation an adhesive process had been broken up.

It might seem unwarranted to draw from so little personal experience such decided and important deductions. However, as it so often happens in Tait's operation, that we find the tubes and ovaries sound, or not sufficiently diseased to account for the mischief, and that their removal cannot explain the speedy relief which follows, I hope in view of these facts, that my observations will be accepted as worthy of consideration. Should these views become verified by further experience, we will then proceed in about the following way: Laparotomy; minute examination of all the pelvic viscera with special attention to adhesions; breaking them up; insinuating hand upwards with sweeping movements between omentum and bowels, and between omentum and parietal peritoneum. These movements have to be made thoroughly, sweeping over all the surfaces, especially the side and spot where was most complaint. Thus a new operation—freeing the peritoneum throughout its entire area—will have been performed, and I hope, with the fullest benefit. Particularly should this operation be tried in young women, to save, if possible, the functions of generation, which consideration should warrant the risk of a second operation, being so little danger in the first one.

As stated in the outset, my object is not to disparage Tait's operation, but in doubtful cases, when we find the ovaries and tubes healthy, let the unfortunate woman have the benefit of the doubt, and let the operation conform to the conditions which are revealed by it.

MEDICAL PROGRESS.

ANATOMY AND PHYSIOLOGY.

THE CHOLERA-BACILLUS.—(In the JOURNAL of June 13th we gave a *résumé* of MR. WATSON CHEYNE'S methods of cultivating the cholera-bacillus. He shows that there are several stages of growth of the cholera-bacillus.) The existence of the straight stage of the cholera-bacillus is of great importance to bear in mind, as it is probably the form which may of the bacilli assume in the intestinal contents in the early period of cholera, and as it would be impossible to recognise them as cholera-bacilli by the microscope alone, more especially when mixed with other bacteria. Hence, the discrepancy between the microscopic estimate and the estimate by cultivation, with regard to the numbers of these bacilli present in any given case, a discrepancy not remarked by me alone, but by several other observers. Indeed, from the very first, Dr. Koch found it impossible to distinguish by the microscope alone, in a mixture of bacteria, these bacilli from "other very similar forms of intestinal bacilli. If now we examine the specimens which have been in the incubator for a longer time (eight to ten hours) we find fewer small bacilli and a large number of larger distinctly curved forms, more especially at the edge of the drop; and in many instances, these are in pairs, forming the S-shaped form described by Dr. Koch. And there may also be a few spirillar forms, but I have not seen many in that stage. After this time development becomes less marked, and apparently soon ceases; whether from exhaustion of the nutriment or of the oxygen contained in the cell I cannot say, but I think most probably for the latter reason.

If a cultivation in the nutrient jelly be examined after two or three day's growth, at a temperature of 18° C. to 20° C., most of the forms will be seen to be markedly curved, though considerable variation exists, and some almost straight rods may often be found. From a very early stage of their growth in gelatin, they tend to group themselves together, to form little irregular zoöglœa-masses—the highly refracting particles seen in the cultivations with a low power, and likened by Koch to bits of glass; while in the fluid jelly (for they render the gelatin fluid), there are large numbers swimming about very actively. Now in these zoöglœa-masses, the bacilli are, as a rule, very distinctly curved. In those free in the fluid, the degree of curvature varies very much, some, as I have said, being almost straight. In the fluid, there will also be found S-shaped forms, consisting apparently of two organisms united end to end with the curves in opposite directions. In some cases, the union occurs with the curves in the same direction, as in the numeral 3. Longer spirillum-like forms may also be observed, likewise evidently composed of a row of comma-bacilli. If the cultivation be examined after five or six weeks, definite spirillar forms will be seen (how formed, whether from continued elongation and twisting of a single individual, or from fusion of the individual members of a chain, I cannot say). The spirals are uniform in thickness throughout, and do not show any trace of division.

Examined under a high power, (one twenty-fifth oil immersion lens), bacilli are very often seen, which do not stain equally throughout, but in which there may be two or three circular parts in which the stain is different in intensity from that in the rest of the rod. Examined on a dark ground, many of the rods are seen to be somewhat beaded, as is so often observed in other bacilli. It is not always possible to demonstrate this beaded appearance in every specimen of these bacilli, hence it probably depends partly on the amount of stain taken up, and partly on the stage of growth of the organism. Mr. E. M. Nelson also states that he has observed flagella in many specimens of this organism, generally one at each end.

The amount of curvature is, as far as I can judge, dependent to a great extent on the rapidity of growth of the organism. The more rapidly it grows, the shorter it is, and the less marked is the curvature. The more slowly it grows within certain limits, the more marked is the curvature, and the greater the number of S-shaped and spirillar forms. The most perfect specimen which I have seen, where the curve was marked in all the organisms, was obtained from a very slow and imperfect cultivation in jelly, which had not been neutralised, and which was distinctly acid. And I am told on good authority, though I have not yet had time to repeat the observation for

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myself, that, if 5 per cent of alcohol be added to the nutrient jelly, the growth is slow, and the great majority ot the forms observed are spirillar. I do not wish, however, to attach too much importance to the mere rapidity of growth as modifying the morphological characters of this organism, because I think other as yet undefined conditions also play an important part.

In glass-plate cultivations, the colonies are evident in about twenty-four hours, and appear, under a low power, as small, somewhat irregular pale masses. These gradually increase in size, and, where near the surface of the jelly, a small depression forms over them, so that, on looking from the side at the surface of such a cultivation, it presents numerous little depressions instead of the original smooth surface of the gelatin, each depression corresponding to a colony of these bacteria. As the colony increases in size, it becomes less compact, and the gelatine in the immediate vicinity becomes fluid. At this stage, the appearance is that of an irregular shaped mass of highly refracting granules, in the centre of a small area of fluid jelly, and floating about in the fluid are also other small refracting masses. When examined with a high power, these masses are seen to be aggregations (zoöglœa-masses) of comma-shaped bacilli, and the fluid is seen to contain large numbers of very actively moving bacilli. The character of the movement is very difficult to determine on account of its great rapidity, but the S-shaped and spirillar forms move in a distinctly corkscrew manner. I do not think that the single bacilli swim in this spiral manner, but of this I am not quite certain. When a bacillus is about to become incorporated in a zooglœa-mass, its motion is very characteristic. It moves backwards and forwards in part of the arc of a circle, the curvature being directed towards the centre of the circle, and away from the mass to which it is ultimately to be attached. After floating backwards and forwards in this way for some time—a movement which, I think, can only be accounted for by the presence of flagella—the range of movement becomes less and less, till the organism comes to rest at the edge of the mass. The colony goes on increasing in size for a few days, but ultimately ceases to extend or extends only very slowly. Dr. Koch reckons the ultimate extent of the colony at about one millimètre. This depends apparently on the amount of gelatin present, and is the result when ten per cent is employed; but apparently, if five or three per cent. gelatine be used, the colony may attain a considerably larger size than that mentioned. Something, I think, also depends on the amount of peptone added to the cultivating material. These appearances on glass-plate cultivations, taken as a whole, are, so far as I am aware, peculiar to the cholera-bacilli. I know no other organism which forms colonies on plates, which cannot be distinguished from those of the cholera-bacilli by a low power of the microscope.

The test-tube cultivations are also characteristic, but hardly so markedly as the glass-plate cultivations. In twenty-four hours, at a temperature of 18° Cent., growth is evident along the needle-track as a whitish line, broader at the upper part, and gradually tapering to the lower (the exact appearance depends of course on the size of the platinum wire employed; in all cases were a typical appearance is wanted, as thin a wire as possible should be used). At the upper part, the gelatine begins to evaporate, and there is slight depression. During the next twenty-four hours, the growth becomes more marked, and the depression increases in size so as to look like an air-bubble at the top of the track. In the following days the jelly at the top becomes liquid, and this liquidity extends gradually to the bottom of the track; thus there is a funnel-shaped appearance, from the greater amount of fluid at the top than at the bottom At same time, the mass of bacilli falls to the bottom of the fluid and assumes a somewhat rosy color, so that there is a rose-colored convoluted string running down the lower part of the track. The fluid at the upper part, which in about a week has extended to the sides of the test-tube, becomes clear, except a very thin layer at the top, which remains opalescent, the top itself being often covered with a very fine scum. Scattered over the solid gelatin forming the sides of the funnel are seen numerous small irregular highly refracting particles. These are the small zoöglœa-masses which have fallen to the sides and bottom of the funnel-shaped cavity. The rapidity with which the gelatine becomes liquid depends very much on the amount of gelatin, and possibly of peptone, present, as before remarked. In about three weeks, the jelly in the tube becomes entirely liquid, and then we have a clear fluid with a somewhat rosy mass at the bottom, a fine scum at the surface, and a narrow layer of opacity beneath it. In such a tube, the bacilli will be found alive after six or seven weeks from the date of inoculation. No one of these characters is of itself peculiar to the cholera-bacilli. They must all be looked at together, and the rapidity of growth must be taken into consideration as well. To my mind, the most typical appearance is that of the highly refracting particles lying on the side of the funnel, the liquid in the neighborhood being quite clear. The only other organism that I know which produces a somewhat similar appearance is Flügge's comma-bacilli, to be mentioned presently.

I have previously mentioned that the reaction of the material should be neutral, or slightly alkaline; and Dr. Koch did not think that this bacillus would grow at all in jelly which had not been neutralized, that is, which was distinctly acid in reaction. Not that he holds that all acids would prevent growth; for he points out that the surface of potatoes is acid, and yet these bacilli can be made to grow on them. I have, however, in two or three instances, obtained distinct growth of the cholera-bacilli in jelly which had not been neutralised, and which was found, when tested, to be distinctly acid. The growth was very slight; and, in fourteen days, there was only a thin whitish growth along the track of the needle (not more than is formed by the typhoid-bacillus in neutral jelly in the same time), and there was no liquefaction of the jelly, nor did the growth spread over the surface of the jelly.

(*To be continued.*)

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